

JOHANNESBURG WATER (SOC) Ltd.
BULK WASTEWATER
PARTICULAR SPECIFICATION
E17 : ELECTRICAL VARIABLE SPEED DRIVE
(VSD) UNITS



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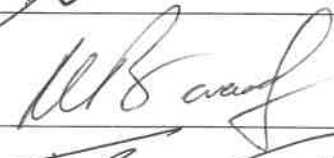

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PARTICULAR SPECIFICATION: VOLUME E17: VARIABLE SPEED DRIVES (VSD)

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E17.1 SCOPE

This specification shall cover all variable speed drives to be designed, supplied installed and tested that shall drive any of the items of equipment to be supplied under the contract.

E17.2 INTERPRETATIONS

E17.2.1 Abbreviations

In this Specification, the following abbreviations will apply:-

- (a) VSD : Variable Speed Drive
- (b) ANSI : American National Standards Institute
- (c) ASTM : American Society for Testing and Materials
- (d) BS : British Standards Institution
- (e) SANS : South African National Standards

E17.2.2 Standards

The latest edition, including all amendments to until the date of tender, of the following particular national and international specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

- (a) SANS 60529 : Degrees of Protection Provided by Enclosures (IP Code)
- (b) IEC 60 664 –1 : Degree of Pollution – no condensation permitted during operation
- (c) IEC 60721-3-3 : Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations
- (d) BS EN 55011 : Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement
- (e) IEC 61800-3 : Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

E17.2.3 Particular Specifications to be read in conjunction with this specifications

The following particular specifications shall be read in conjunction with the Project Specification:

- (a) E04 : PARTICULAR SPECIFICATION FOR MCC

E17.3 GENERAL REQUIREMENTS

- (a) The VSD units shall control asynchronous motors with standard constant torque, variable standard torque or optimized torque.
- (b) The VSD units shall be specifically designed to offer extensive flexibility in water and wastewater applications.

- (c) The VSD units shall be provided with six programmable, isolated digital inputs (24V DC, positive or negative logic).
- (d) VSD units shall have three programmable relay outputs (1 with NO/NC contacts and 2 with NO contacts)
- (e) The VSD units shall be provided with 3 programmable analogue inputs (configurable as voltage (0...10 V) or current (0-20 mA/4-20 mA), 2 of them including probes (PTC, PT100, PT1000 or KTY84)).
- (f) The VSD units shall have two programmable analog outputs configurable as voltage (0...10 V) or current (0-20 mA).
- (g) The VSD units will have the option to extend the I/O with optional modules.
- (h) The VSD shall have low-noise motor operation due to high pulse frequencies.
- (i) The VSD unit shall have complete protection for motor and inverter.
- (j) The VSD units shall comply with the requirements of the EU low-voltage guideline.
- (k) The VSD unit shall have the CE marking.
- (l) All VSD units shall have the same interface, including a control panel, I/O connections and software, regardless of power rating, voltage or enclosure (IP rating).
- (m) All VSD units shall be supplied with an internal Class A filter. The requirements are fulfilled using shielded cables with maximum length of 25m.
- (n) The VSD units shall be supplied with line commutating choke in line with EN61 000-3-2 Regulations "Limits for harmonic currents with device input current $\leq 16\text{A}$ per phase".
- (o) The maximum permissible motor cable lengths (shielded/unshielded) for a mains voltage of 400V are 150 m/ 225 m.
- (p) The VSD units shall be supplied with integrated category C3 EMC filters.
- (q) The VSD units shall be supplied with graphic display terminal for parameterising the inverter, complete with mounting kits for installation in the control cabinet doors.
- (r) The unit shall have complete protection for motor and inverter.
- (s) The VSD units shall have the following standard communication modules Modbus/TCP, Modbus serial link.
- (t) The VSD units shall have the following optional communication modules EtherNet/IP and Modbus/TCP Dual port, ProfiNet, CANopen, Profibus DP V1, DeviceNet, and BACnet MS/TP.
- (u) Depending on the power rating and application, the VSD unit should be available as a wall mounted unit, a cabinet integration unit or a floor-standing unit.
- (v) **Note:**
Attention shall be given to ventilation to prevent the accumulation of heat in cubicles where power electronic drives (soft starters and VSD's) or other heat generating equipment (i.e. control transformers) are contained. Extraction ventilation fans should be installed in these cases to remove heat from the cubicle. The filtered extraction fan should be placed as high as possible in the compartment door with a filtered air inlet opening as low as possible in the compartment door. The fan and opening must be sized to ensure all generated heat is extracted from the cubicle. Natural convection cooling will not be accepted. All specific requirements from the VSD OEM must be adhered to.

E17.4

WORKING VOLTAGE AND SUPPLY SYSTEMS

Depending on the power rating and application, the following power supply alternatives shall be available:

- i. Single-phase: 200...240 V
- ii. Three-phase: 380...480 V

E17.5 ENVIRONMENTAL LIMITS

E17.5.1 Operating Temperature

The VSD must be able to operate in the specified operating temperature without any derating of the specified output power

- i. 0... 40 °C as standard
- ii. 40...50 °C with derating

E17.5.2 Relative humidity

- i. 5...95% without condensing.

E17.5.3 Storage and transport temperature

- i. -40...+70 °C

E17.5.4 Operating altitude:

- i. 0...1,000 m without derating
- ii. 1,000...2,000 m with derating of 1% per 100 m

E17.5.5 Withstand to harsh environments:

- i. Chemical class 3C3 conforming to IEC/EN 60721-3-3 (1)
- ii. Mechanical class 3S3 conforming to IEC/EN 60721-3-3 (1)
- iii. Electronic cards with protective coating

E17.5.6 Ingress Protection:

- i. IP 00 for mounting in an enclosure.
- ii. IP 20/21/UL type 1 for wall mounting in a plant room and in an enclosure
- iii. IP 55 for wall mounting, with protection against dust and water jets
- iv. Floor-standing IP 21
- v. Floor-standing IP 54, with protection against dust and water jets

E17.6 PROTECTION FUNCTIONS

The following protection functions shall be available:

- (a) Under voltage
- (b) Overvoltage
- (c) Overload
- (d) Earth faults
- (e) Short-circuits
- (f) Stall prevention
- (g) Locked motor protection
- (h) Motor over temperature
- (i) Inverter over temperature parameter change protection.

E17.7 ASSEMBLY METHOD AND PROTECTION CLASS

The VSD units should be available with listed mounting types and IP classes:

- (a) Wall-mounting
 - i. IP 20/21/UL Type 1 from 0.75 to 315 kW,
 - ii. IP 55 from 0.75 to 90 kW.
- (b) Floor standing
 - i. IP 21 and IP 54 from 110 to 315 kW
- (c) Cabinet integration
 - i. IP 20 from 0.75 to 90 kW.

E17.8 DOCUMENTATION

Technical details shall be delivered with the offered VSD unit:

User manual, describing systematically how to install, start up, trouble shoot and maintain the VSD. It shall be optionally possible to acquire multiple manuals together with a delivery unit.

Documents to be delivered per order:

- a) Dimensional drawings (both AutoCAD and .pdf formats)
- b) Customer connections and power wiring diagrams (both AutoCAD and .pdf formats).
- c) Power losses and cooling air temperature (both in .xls and .pdf formats).
- d) Manufactures statements on output currents available continuously in different ambient temperature up to 50°C. Type of product needed at 50°C continuous operations must be clearly listed.
- e) Environmental product declaration according to life cycle assessment (LCA).

E17.9 INSTALLATION, TESTING AND COMMISSIONING

The contractor will supply a factory test certificate with the VSD unit.

The VSD shall be installed and commissioned by a competent person approved and accredited by the manufacturer. The installer must provide a method statement for transporting, storage, installation, testing and commissioning processes for approval by the engineer.

The installer is required to perform site acceptance tests (SAT) on the VSD witnessed by the employer and the engineer, prior to commissioning the VSD. The contractor will be responsible for the VSD setup, including software configuration and settings. A schedule of the checks, tests and results of the SAT must be available for signing by the engineer at the completion of the SAT. The contractor will provide the final VSD setup and software settings to the Engineer on a USB flash drive.

A thermal imaging record of the VSD shall be taken after the VSD has been in operation for a

minimum one week under typical normal conditions and while running. The thermal imaging record will form part of the deliverable documentation together with Operation and Maintenance Manuals and delivered to the employer on completion of the works.

E17.10 MEASUREMENT AND PAYMENT

VSD units shall not be paid as a separate item in the Bill of Quantities. VSD unit form part of motor starter circuits and payment thereof shall be included in the price/s of motor control centres.